PROGRESS REPORT

COASTAL GRIZZLY RESEARCH PROJECT

1982

YEAR 1

by

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SUMMARY

This report summarizes the first seasons field work of the Coastal Grizzly Bear Research Project. In 114 days of field work, project staff trapped 34 bears (12 grizzlies, 22 black bears) a total of 42 times. Traps were set for 98 days for varying periods of time at 51 different locations throughout the Kimsquit study area; a total of 1234 trap nights were recorded. Of the twelve grizzlies captured, five were yearling cubs, three were adult females, three were adult males, and one was a subadult male. Selected bears were fitted with radio transmitters. Collared bears were located a total of 72 times during 20 aircraft relocation flights (excluding cubs with females). Preliminary home range calculations were performed. The results of analysis of 100 scats collected in 1982 are presented. One grizzly den-site was located and measured in the spring of 1982. Denning areas of the collared bears were located. Due to the emphasis on trapping and the curtailment of logging activity in June, limited data on the effects of timber harvest on coa[illegible]rizzly ecology were collected.

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INTRODUCTION

As a result of increasing concern by wildlife managers on the effects of timber harvesting on grizzlies in coastal forests, the Wildlife Research Section of the B.C. Wildlife Branch conducted a problem analysis to identify and rank research requirements (Archibald 1983). Subsequently, the Ministries of Environment and Forests formally agreed to undertake a jointly funded and administered research project with the following objectives:

1. to identify seasonal habitat requirements of coastal grizzlies;

2. to determine the impacts of timber harvest on coastal grizzly bears in the absence of hunting;

3. to determine baseline population characteristics of coastal grizzlies.

Management relevance and project direction is provided by a Research Advisory Committee with representation from: Ministry of Environment - Wildlife Research Section and Regions 1, 2, 5, and 6; Ministry of Forests - Research Branch, and Prince Rupert and Vancouver Forest Regions; and, University of British Columbia - Faculty of Forestry. A working plan has been prepared that details project objectives, hypotheses to be tested, and proposed methodologies (Archibald and Hamilton 1983).

The following report provides a description of the study area and summarizes accomplishments of the 1982 field season.

Many individuals contributed significantly to the first season's field work. Special thanks go to Rai Thomas, Ernie Beadle and Walter Vorhadsky of the Mid Coast Forest District for their assistance with equipment and transportation. Sparmac Timber, in particular Ken Cessford and Barry Johnstone, were gracious hosts during our spring stay in their camp and were helpful on several occasions throughout the summer. Able field assistance and good company were provided by Bob Forbes, Ken Kowal, Rick Marshall, John Nagy, Tom Smith, Ben vanDrimmelen, and Rob Woods. Helicopter pilots, Rob Skelly and Dale Griffin, were extremely adept and helpful. Finally, Wilderness Airlines deserve credit for not only doing a fine job on our relocation surveys but also for not complaining once about carrying bait.

STUDY AREA DESCRIPTION

LOCATION

The study area is located at the head of Dean Channel, (53°N, 127°W) and includes the entire Kimsquit River basin. The mouth of the Kimsquit is 60 km north-northwest of Bella Coola or about 500 km northwest of Vancouver (Fig. 1). To the north and east, the study area is bounded by Tweedsmuir Provincial Park. The western edge is roughly the southeastern limit of Tree Farm Licence #41. The Kimsquit is well inland - approximately 140 km from the open Pacific - Dean Channel being one of the furthest inland reaching inlets on the B.C. coast. The river passes through a narrow canyon just upstream of King George Creek (Fig. 1) conveniently dividing the watershed into the upper (upstream of canyon) and the lower valley (downstream of canyon).

Administratively, the watershed is located in Management Unit 5-9 of the Ministry of Environment Region 5. The area is also within the Ministry of Forests Bella Coola Forest District, of the Vancouver Forest Region, and is part of the Mid Coast Timber Supply Area (T.S.A.).

CLIMATE

The study area has a transitional sub-oceanic climate as described by Yole et al. (1982). Records from the closest official climate stations at Kemano (95 km NE) and Bella Coola are summarized in Appendix A. Weather data collected by company personnel at the Kimsquit camp beginning in 1979 are also available.

The area is characterized by wet fall months, cool winters, and warm, moist summers. Rainfall is moderate, 1900 mm annually, compared to the outer coastline but snowfall is heavy, 3400 mm annually (Yole et al. 1982).

Considerable variation occurs in the annual climatic regime. The winters of 1979-80 and 1982-83 were abnormally mild, with well below average snowfall. This variability may have significant impact on the denning and spring movements of the bears.

The upper valley is cooler and wetter than the lower watershed, and is therefore more broadly representative of the Mid Coast T.S.A. This difference can be observed in the vegetation patterns, which reflect the upper valley's dominantly coastal influence and the lower valley's more coast-interior transitional climate.

PHYSIOGRAPHY AND GEOLOGY

The study area is part of the Kitimat Range of the Coastal Mountain system and is found in Holland's (1976) Coast Mountains Physiographic Region. The topography is rugged with steep mountains rising abruptly from sea level to over 2000 m. To the north and east, the study area approaches the Fraser Plateau of the Interior Plateau Physiographic Region, an area characterized by far gentler terrain and few active glaciers.

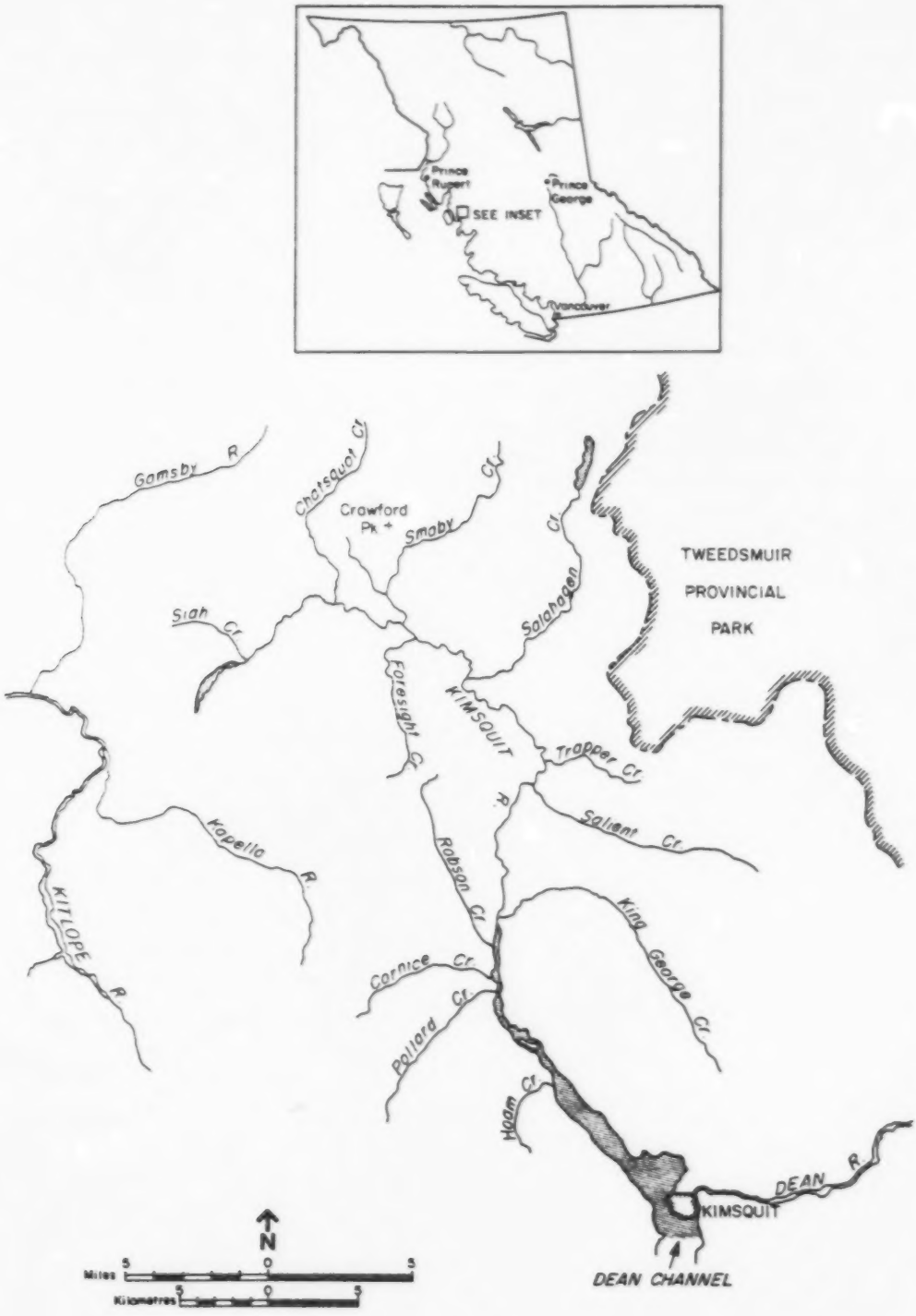

Figure 1. LOCATION OF STUDY AREA

The bedrock geology of the Kimsquit is similar to other coastal areas. The major rock types are igneous instrusives, primarily granites and dicrites (Baer 1968). They are resistant to weathering; thus, colluvial fragments are usually large. Breakdown of the smaller particles is accelerated by the acidic, humid environment of the coast (Yole et al. 1982).

The Mid Coast was heavily glaciated during the Fraser Glaciation approximately 13 000 years ago, and many of the landforms and surficial deposits are a result of the various processes associated with glacial activity. A number of small glaciers (icefields) remain active in the study area; the river is coloured by various amounts of glacial rock flour and, therefore, seldom runs clear. Since glaciation, there has been significant deposition of colluvial, organic, and fluvial materials (Yole et al. 1982). The variations of substrate, topography, and climate have combined to provide a heterogenous environment for the development of soils and vegetation.

The following landforms (in approximate order of decreasing area) can be found in the Kimsquit watershed: steep shallow to bedrock colluvial veneer; deeper colluvial blanket that occurs on steep valley slopes; rock, glacial - deposited morainal blanket and veneer on hummocky terrain; icefields; fluvial or water-deposited level or floodplain deposits; fans and terraces; organic bogs; and, recently exposed glacial deposits (Louie 1975). The inherent instability of some of these landforms has implications in terms of forestry development.

VEGETATION

The following discussion of the vegetation of the Coastal Grizzly Research Project Study Area is divided into two sections. After a general physiognomic overview, the classification system of choice - the biogeoclimatic - will be introduced and the classification of the Kimsquit within the Coastal Western Hemlock (CWH) zone, the Subalpine Mountain Hemlock (MH) Zone and the Alpine Tundra (AT) zone will be briefly characterized.

Although considerable effort will be devoted to classification of the vegetation of the study area with regards to bear habitat throughout the project, we are fortunate to have several initial sources of information available including Cheston et al. (1975), Louie (1975), Yole et al. (1982), McAvoy (1931), as well as forest cover maps and the cutting plan prepared by Doman Industries, John G. Liveland and Associates, and Integrated Resources Photography Ltd.

General Description - Physiognomic

For ease of description, the following overview is arranged according to a primarily physiognomic scheme. The majority of the information has been taken from Yole et al. (1982) and concentrates on that part of the study area covered by the CWH biogeoclimatic zone.

Coniferous forests cover the largest proportion of the vegetated area, with Tsuga heterophylla (western hemlock) being the dominant climatic climax species. Depending on the local micro-climate and edaphic features, western hemlock may be accompanied by a variety of other conifers, each of which has a unique range of ecological tolerances. These species may dominate edaphic climaxes. For example, Pseudotsuga menziesii (Douglas-fir) and Pinus contorta (lodgepole/shore pine) are found on the rapidly drained side slopes of the lower valley. Thuja

plicata (western redcedar) prefers wetter sides as do Picea sitchensis (Sitka spruce) and Chamaecyparis nootkatensis (yellow-cedar). Abies amabilis (amabilis fir) is found throughout the upper valley and on some moister, shadier sites in the lower Kimsquit. At higher elevations, in areas of heavy snow deposition, Tsuga mertensiana (mountain hemlock) is commonly found. Detailed information on the ecological characteristics of B.C. conifers can be found in Krajina (1970) and Krajina et al. (1982).

Considerable areas of the watershed, primarily in the lower valley, are covered by deciduous forest. Two tree species dominate: Alnus rubra (red alder) and Populus balsamifera ssp. trichocarpa (black cottonwood). Alnus rubra is a fast growing pioneer that has a symbiotic relationship with a nitrogen-fixing bacteria. This ability, together with its rapid regeneration rate enable it to colonize and dominate cutover areas and other disturbed sites. Populus balsamifera ssp. trichocarpa with its high flood resistance, dominates the alluvial seral areas of the lower Kimsquit. The two species are commonly found together. The deciduous forests have relatively open canopies and thus a productive understory.

Although shrub-dominated areas do not make up a large proportion of the vegetation, they occur throughout the study area. Five main types are recognized: slide tracks on avalanche chutes, riparian areas, fringes of organic bogs, subalpine shrub areas, and "recent" clear cuts. On the avalanche chutes, Alnus viridis ssp. sinuata (Sitka or slide alder) is usually dominant; however, Acer glabrum (Douglas maple) is abundant on drier tracks (Yole et al. 1982). Numerous shrubs occur in the seral riparian areas, a number of which are important bear food plant species such as: Rubus spectabilis (salmonberry), Oplopanax horridus (devil's club), and Sambucus racemosa (red-elderberry). Other species found in the study area include: Cornus sericea (red-osier dogwood), Lonicera involucrata (black twinberry), a number of Vaccinium and Salix spp., Myrica gale (sweet gale) and Rubus parviflorus (thimbleberry). Open "subalpine shrub" areas are more common in the upper reaches of the eastern tributaries of the Kimsquit, towards Tweedsmuir Park. Recent clearcut areas of the Kimsquit are relatively open. Residual shrubs and coniferous regeneration are expected to increase their growth, regardless of planting, within five years after overstory removal (Alaback 1982). An adjacent watershed, the Dean River, was logged as recently as 1976. These cutover areas may offer an opportunity to investigate shrub colonization or regeneration, cover, and productivity over time.

Two significant areas of the Kimsquit are dominated by grass-like plants: the tidal flats and estuary, and a large organic bog in the upper valley. Subalpine meadows, sometimes associated with avalanche tracks, and alpine areas on the eastern edge of the study area may also be dominated by grasses and sedges. Total coverage of such areas is comparatively small.

Open herb meadows are commonly found on the avalanche tracks throughout the valley.

Mosses, liverworts and lichens are found in the study area in environments too harsh for vascular plants (Yole et al. 1982). They grow on rocky outcrops and boulders, with high coverage in the many rocky alpine areas in the Kimsquit watershed.

Biogeoclimatic/Ecosystematic Classification

In recent years, the B.C. Ministry of Forests has adopted, with some modifications the biogeoclimatic/ecosystematic system of forest classification originally developed by Dr. V.J. Krajina and his students at the University of British Columbia. By incorporating climate, soil, and vegetation data into the classification, the system provides an ecological basis for forest land management. It is not within the scope of this report to outline the objectives, principles, philosophy, or methodologies of the biogeoclimatic system. The reader is referred to Krajina (1970), Klinka et al. (1979), Kojima (1981), Pojar (1982), and Stevenson (1982).

A frequent criticism of the biogeoclimatic system is the manner in which it deals with seral vegetation. Opponents point to the concept of potential climatic climax vegetation on "zonal" sites - which is the basis of the classification - and question how various seral stages can be incorporated, particularly when the climax may be reached along a number of different successional pathways, and when climaxes resulting from influences other than climate are common (e.g. edaphic, topographic, topoedaphic, or fire) (Yole et al. 1982).

Although the biogeoclimatic system classifies potential climax ecosystems, seral vegetation can be incorporated. Unless excessively altered, the ecosystem remains after disturbance; the seral vegetation reflects the potential and limitations of the original, enabling identification of successional trends. Seral ecosystems can, therefore, be recognized, described, and integrated (Yole et al. 1982). Since much of the important bear habitat in the study area appears to be successional (e.g. avalanche chutes, riparian areas), successful incorporation of seral development is critical to satisfying project objectives.

1. Coastal Western Hemlock Zone (CWH)

The Coastal Western Hemlock biogeoclimatic zone is both the most productive for forestry and the most researched in British Columbia. A number of publications have dealt with the ecology, classification, and management of the CWH including Klinka et al. (1977, 1979, 1980, 1981), Klinka and Carter (1980), Kojima (1981), Pojar (1981), and Inselberg (1982). The zone covers a large geographical area extending from Southeastern Alaska along the inner coastline to Washington, as well as parts of Vancouver Island and the Queen Charlotte Islands. The elevational limits of the zone vary with latitude, becoming lower towards the northern coast (Yole et al. 1982). The climate of the CWH is relatively mild (mesothermal) and rainy; temperature, rather than moisture is the main limiting factor influencing tree growth. At present, the range of the "coastal" ecotype of the grizzly bear in B.C. is believed to correspond to distribution of the CWH and the zones found above it, the Subalpine Mountain Hemlock, and the Alpine Tundra zones (except on Vancouver Island and the Queen Charlotte Islands).

Two subzones of the Coastal Western Hemlock biogeoclimatic zone, differentiated primarily on the basis of climate, can be found in the study area (Yole et al. 1982). The "i" or Wetter Maritime subzone includes lower elevations of the upper Kimsquit valley and is more broadly representative of the Mid Coast

area. The "h" or Mid Coast Drier Transitional Subzone is found in the lower valley (Fig. 2)[a].

Biogeoclimatic subzones are further subdivided into variants on the basis of finer divisions of climate. Variants are usually warmer or cooler or wetter or drier than what is considered average for the subzone (Klinka et al. 1979). These climatic differences result in corresponding differences in vegetation, soil, and ecosystem productivity (Yole et al. 1982). Three variants have been recognized for each of the two Mid Coast subzones of the CWH. Yole et al. (1982) have classified the lower Kimsquit (lower elevations) as part of the CWHh3 or the Transitional western hemlock-Douglas-fir (amabilis fir-western redcedar) variant. The upper valley, noticeably wetter, is in the CWHi3 or the Eastern wetter transitional variant.

Separate from, but integrated with the biogeoclimatic hierarchy of classification (i.e. zone, subzone, and variants), the ecosystematic categories within the system (ecosystem association, type, and phase) enable practical field observations, description, and classification of existing vegetation. An ecosytem association is defined as all ecosystems (land area plus their biota) capable of belonging to the same plant association at climax (Yole et al. 1982). Appendix B summarizes ecosystem associations identified to date for the CWHh3 and CWHi3 variants.

2. Subalpine Mountain Hemlock Zone (MH)

The Subalpine Mountain Hemlock zone, restricted to coastal British Columbia, forms a fairly continuous north-south band along the Coast Mountain Range. It occurs where higher elevations or northern latitude result in a more snowy microthermal or subalpine climate than for the CWH. The topography within the zone is rugged and, through its influences on snow accumulation and duration (and thus moisture regime), is one of the most important influences on soil formation and floristics. Two subzones of the Subalpine Mountain Hemlock zone have been identified and characterized: parkland and forest (Brooke et al. 1970). The parkland subzone is characterized by its scattered tree cover, more severe climate, and longer duration of snow cover. Mountain hemlock is the climatic climax tree species in this subzone on the windward side of the coast range and is associated with amabilis fir and yellow-cedar (Brook et al. 1970).

3. Alpine Tundra Zone (AT)

The Alpine Tundra zone occurs throughout the province at high elevations. No trees thrive well although some krummholz forms may develop. The climate is severe, with the mean annual temperature from -4 to -1.5C and the number of frost free days less than 25 (Krajina 1970). Seventy-two to seventy-four percent of the annual precipitation is in the form of snow which persists late into the spring. A coastal subzone has been identified, ATa (Krajina 1970), but there has not been extensive research into its distribution and characteristics.

Both subzones of the subalpine Mountain Hemlock zone and the coastal subzone of the Alpine Tundra zone are well represented in the lower and the upper Kimsquit Drainage. Much of the "subalpine shrub" area of the eastern tributaries

[a] Figure 2 is based on post-1982 classification and mapping.

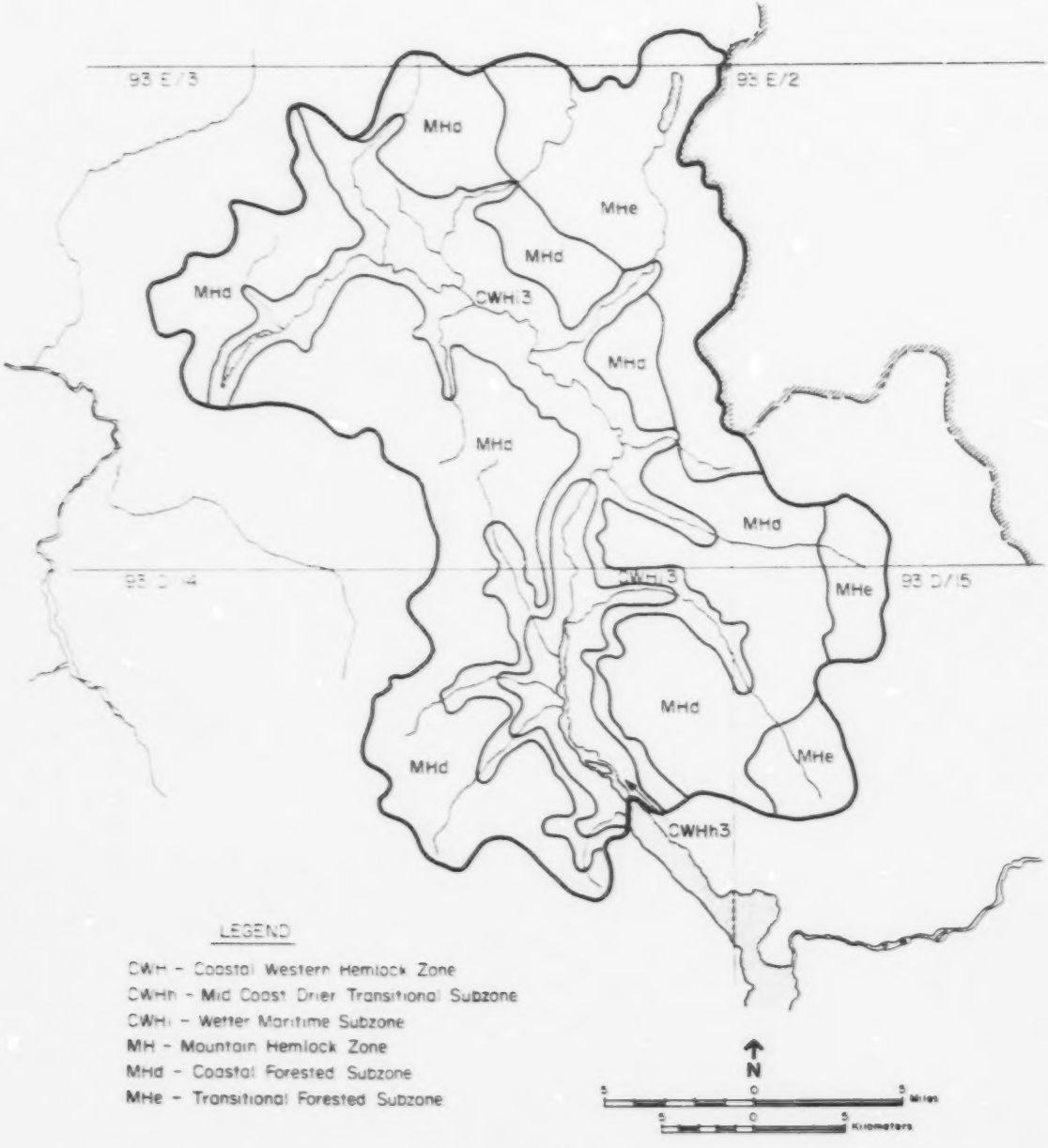

Figure 2. MAP OF FORESTED BIOGEOCLIMATIC SUBZONES OF THE KIMSQUIT RIVER VALLEY

is in the parkland subzone of the MH. Considerable areas of the ATa are non-productive, being dominated by bedrock, talus slopes and active icefields.

FISHERIES RESOURCES

The Kimsquit is considered one of the most important fishery systems of the central coast (Anon. 1976). All five species of Pacific salmon (sockeye - Oncorhynchus nerka, chinook or spring - O. tshawytscha, coho - O. kisutch, chum - O. keta, and pink - O. gorbuscha) spawn in the watershed from tidewater to Kimsquit Lake. The river also has significant runs of cutthroat trout (Salmo clarki) and Dolly Varden char (Salvelinus malma). Unlike the neighbouring Dean River, steelhead trout (Salmo gairdneri) are rare in the Kimsquit. Table 1 taken from Manzon and Marshall (1980) and supplemented with information from Mr. G. Savard (pers. comm.), summarizes spawning escapements since 1947 and outlines timing of the runs. Of particular importance to the bears are the large pink, chum, and sockeye runs. The pink and chum runs are restricted to the lower valley which has an abundance of both spawning and rearing areas. Many sockeye that die after spawning late (about October 15) in Kimsquit Lake are frozen in the surface ice and provide an early spring food source for grizzlies.

In 1982, the first spring salmon were observed on June 21 and the first pinks observed on July 20. We were not able to make observations on the arrivals of the other three species. There were large runs of pinks and chums in 1982, but the spawning effort may have been severely affected by flooding during the second week of September.

WILDLIFE

The Kimsquit watershed supports an abundance of wildlife: dense populations of black and grizzly bears; Sitka black-tailed deer; moose; mountain goats; wolves; river otter; beaver; marten; seals; and sea lions. The valley is also rich in bird species including raptors (a large number of bald eagles use the spawning salmon), waterfowl (mergansers were the most common), and numerous other species. More specific information on the numbers and distribution of the large mammals, and details of their interspecific interactions with bears, will be given in subsequent reports.

HISTORY

In the following brief summary of the Kimsquit's history, native Indian use, fur trapping, early timber harvest, and the grizzly bear kill record for the watershed (and vicinity) will be discussed. Of these, the latter two are significant factors which should be considered while interpreting study results.

Native Indian Use and Fur Trapping

The book, Bella Coola, by Kopas (1970) provides a good summary of the local native Indian history. The Bella Coola Indians established a village at "Kimsquit" which is actually at the mouth of the Dean River. A travel route from the Kapella River to Eutsuk Lake traversed the upper valley. The Chatsquah Indian Reserve is located near the mouth of the river and is about 178 ha (440 acres).

Table 1. Escapement record for Kimsquit River (and Lake), 1947-1982

Year	Sockeye	Chinook	Coho	Chum	Pink	Steelhead
1947	750	3500	1500	7500	7500	3500
1948	3500	1500	3500	7500	7500	750
1949	7500	750	7500	7500	3500	750
1950	7500	750	7500	15000	7500	750
1951	7500	3500	7500	35000	15000	750
1952	7500	1500	7500	35000	7500	750
1953	7500	750	3500	75000	3500	
1954	15000	1500	7500	35000	7500	1500
1955	3500	1500	7500	7500	3500	1500
1956	7500	3500	7500	35000	7500	Unk[a]
1957	7500		7500	7500	3500	
1958	Unk	Unk	Unk	Unk	Unk	
1959	3500	Unk	Unk	7500	Unk	
1960	7500	Unk	Unk	15000	3500	
1961	N/O[b]	N/O	N/O	35000	3500	
1962	3500	N/O	N/O	15000	3500	
1963	N/O	N/O	N/O	75000	3500	
1964	N/O	750	N/O	75000	1500	
1965	N/O		N/O	1500	200	
1966	Unk		N/O	35000	7500	
1967	15000	Unk	Unk	35000	Unk	
1968	3500	N/O	Unk	75000	35000	
1969	3500	N/O	Unk	35000	N/O	
1970	3500	3500	3500	60000	60000	
1971	75000	N/O	N/O	35000	N/O	
1972	13500	75	N/O	65000	40000	
1973	3500	200	3500	85000	N/O	
1974	3500	25	3500	50000	55000	
1975	35000	25	3500	45000	400	
1976	25000	150	4000	35000	15000	
1977	10000	200	3500	30000	500	
1978	12000	400	3500	5000	5000	
1979	8000	400	3000	35000	100	
1980	7500	400	1500	30000	15000	
1981	5000	few	2500	10000	100	
1982	12000	100	1000	40000	5000	
Timing:						
Arrive	July	July	Sep	E.[c] Aug	Aug	
Start	Sep	Aug	Oct	E. Aug	Aug	
Peak	M. Oct	Aug	Nov	L. Aug	M. Aug	
End	Nov	Sep	Dec	Oct	Sep	

[a] Unk - Evidence of fish present but no estimates were made.
[b] N/O - The stream was inspected but no fish were observed.
[c] E - early (1st to 10th of month); M - mid (11th to 20th); L - late (21st to end of month).

The extent of fur trapping in the valley is unknown. Old trap sites are frequently encountered and two decaying cabins have been located. Sometime during the 1920's, a trapper is said to have taken forty grizzly bears from the valley (C. Mack, pers. comm.)

Historic Timber Harvest

The high timber value of the Kimsquit Drainage has long been recognized. Pulp Lease 5 - two lots of which were located in the lower valley - was granted to the Bella Coola Development Company November 1, 1909 who then assigned it to Ocean Falls Company Limited and Western Canada Trust. The Ocean Falls Company was in the process of constructing a combination pulp and saw mill, about 120 km (75 miles) down Dean Channel from the Kimsquit, at Ocean Falls. Lots 204 (1575 acres or 638 ha) and 51 (565 acres or 229 ha) were not logged until 1918-1919 after the acquisition of the mill and lease by Pacific Mills Ltd. Pacific Mills was a subsidiary of the Crown Willamette Company - later to be known as Crown Zellerbach - and had taken over the financially troubled Ocean Falls operations in August, 1915. Three timber sales, adjacent to the pulp lease lots, were also granted to Pacific Mills and timber was removed from them at the same time. The company had constructed a light railway up the valley and although they had both cruised and applied for further timber sales, after a change in management, they abandoned the Kimsquit operation. Further details on cruises, stumpage assessments, and amount harvested by species have been collected and will be summarized in a future report.

Hunter Harvest History

The productivity of the Kimsquit for grizzly bears has also been recognized for a long time. A. Bryon Williams, B.C.'s first Provincial Game Warden, wrote in his 1935 book Fish and Game in British Columbia:

> "While there are Grizzlies at the heads of all the long inlets on the coast, they are not so easy to hunt in the spring, partly owing to the scarcity of good "slides," but more so to the probability of poor weather conditions. On the other hand, when the salmon are running, as has already been commented on, it is quite easy until they scatter up side streams. Probably the pick of the inlets are Knight, Kinocome, Rivers, Dean Channel, North Bentick Arm and Gardner Channel. About six miles from the head of Dean Channel is the Salmon River * and at the head the Kimsquit. Both these streams are very good both in spring and fall, as also is the Bella Coola River and one or two of its tributaries, while Gardner Channel has the famous Kemano, the Kitlobe and several other streams running into it."

* Dean River

It is unknown how many grizzlies were taken from the Kimsquit in the early part of this century. A record of more recent kills has been compiled with the assistance of Fish and Wildlife Branch staff and two guide-outfitters who

formerly hunted the area (C. Mack and D. Hodson, pers comm.). The information is summarized in Table 2 (verified kills) and Table 3 (suspected kills). A preliminary record for grizzlies killed in the nearby Lower Dean River is also given (Table 4). A number of other potential kills are being investigated.

Regardless of the number of verifiable grizzly kills, the Kimsquit drainage has received considerable hunting pressure since 1965 (20-25 bears?). Grizzlies may live to at least twenty years old; the impact of this harvest level on present day population natality, mortality, age structure, and movements is, therefore, significant. However, as baseline (i.e., unhunted) population parameter data for coastal grizzlies are limited, the nature and extent of the harvest impact will be difficult to determine.

PRESENT DAY TIMBER HARVEST

The current timber rights to the Kimsquit Valley are held by Doman Forest Products Ltd. in the form of a Timber Sale Harvesting Licence. Logging has been carried out by Sparmac Timber Ltd. Development began in 1979 with a dryland sort area, some road and camp construction. Road construction continued in 1980 and, by 1981, Sparmac was ready to begin logging. Logging activity was suspended in June 1982 due to an unusually long period of hot, dry weather, and was not resumed.

To date approximately 170 ha have been clearcut in four cutting areas and about 115 000 m^3 removed. Additional timber has been removed from the road right of ways. Road construction is complete to four other cutting areas on the west side of the river (Fig. 3). Bridges have been constructed over Hoam, Pollard, Cornice, and Robson Creeks. Cutting area 2 (lower Pollard Creek) was tractor-logged while the other areas were cleared by mobile highlead.

The licencees have submitted 20-year-and 5-year-development plans as required by the B.C. Ministry of Forests. A cutting permit for the first eight cutting areas (418.7 ha) has been issued. Of approximately 20,000 ha of merchantable timber in the Kimsquit drainage, only 9500 ha are considered economically accessible, 8800 ha of which can be cut in the "first pass." The plan states that "at an anticipated rate of cut of 226 535 m^3 (per year), it would take approximately 23 years to remove the presently available timber."

There has been considerable interest from government agencies and the public in the Kimsquit planning process. Public meetings have been held, both to provide information and solicit comment. Federal Fisheries has taken an active role with the objective of preserving the valley's productive salmon resource.

Table 2. Verified grizzly kills by hunters in the Kimsquit watershed.

Date	Sex	Age (yrs.)	Location	Comments
1967	F	12-15	Lower Kimsquit	Large 400/500 lbs.
1972	M	12-15	Upper Kimsquit	Large 650/700 lbs.
1972	M	8-10	Upper Kimsquit	Medium 450/500 lbs.
1977	M	22	Kimsquit Lake	Skull length 421 mm Skull width 235 mm
1978	M	12	Chasquot Creek	Skull length 398 mm Skull width 231 mm
?	M	15-20	Upper Kimsquit	Large 750/800 lbs.

Table 3. Suspected grizzly kills by hunters in the Kimsquit watershed.[a]

Year	Sex	Comments
1965	?	J. N. Olsen guide-outfitter
1965	?	J. N. Olsen guide-outfitter
1966	?	J. N. Olsen guide-outfitter
1967	M	J. N. Olsen guide-outfitter
1967	F	J. N. Olsen guide-outfitter
1968	M	J. N. Olsen guide-outfitter
1968	F	J. N. Olsen guide-outfitter
1969	F	J. N. Olsen guide-outfitter
1969	F	J. N. Olsen guide-outfitter
1969	F	J. N. Olsen guide-outfitter
1969	M	J. N. Olsen guide-outfitter

[a] NOTES:

1) Mr. J.N. Olsen (deceased) apparently hunted entirely in the Upper Dean Channel. To date, it is unknown if some of the bears reported above are from the lower Dean or all from the Kimsquit Watershed.

2) From 1960 to 1976, Mr. Clayton Mach successfully guided over 75 grizzly hunts. Some of these were from the Kimsquit and Lower Dean Rivers.

3) Another guide outfitter, Mr. Cy Ford, hunted the Salahagen Lake (Upper Kimsquit) vicinity in the 1960's but did not take any bears within the watershed.

Table 4. Verified grizzly kills in the lower Dean River

Date	Sex	Age	Location	Comments
1969	M	4 years	Lower Dean	Small 350/400 lbs.
1979	M	2 years	Lower Dean	Animal Control
1979	M	2 years	Lower Dean	Animal Control
1980	F	3 years	Lower Dean	Resident hunter
1981	F	2 years	Lower Dean	Resident hunter
1982	M	_ years	Lower Dean	Collared bear #34[a]

[a] (see Movements)

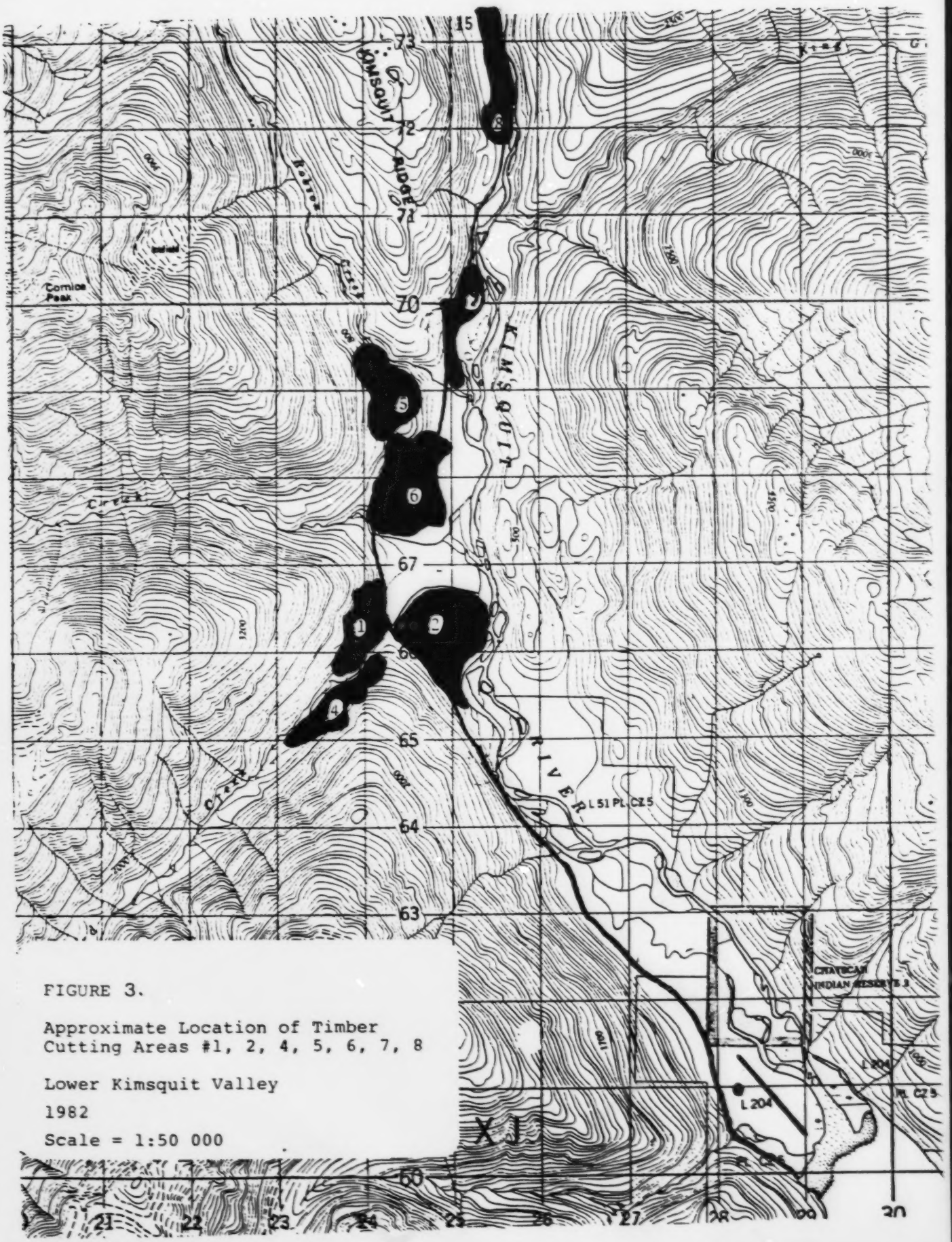

FIGURE 3.

Approximate Location of Timber Cutting Areas #1, 2, 4, 5, 6, 7, 8

Lower Kimsquit Valley

1982

Scale = 1:50 000

1982 FIELD SEASON

Discussion of the 1982 field season of the Coastal Grizzly Research Project is divided into several sections. After a brief outline and description of methods, trapping efforts; capture and handling results; relocation-movement-home range information; scat analysis and food habits; and, den, daybed and mark tree data are summarized.

OUTLINE

The emphasis of field activities in 1982 was on trapping and radio collaring a representative sample of grizzly bears resident to the Kimsquit watershed. Preliminary movement and food habit information were also collected.

Field work began on March 31, when a reconnaissance flight of the valley was made to help decide the start-up date for spring capture efforts. A helicopter accessed trapline was begun on April 19 and ran until May 18, covering the watershed up to Kimsquit Lake. Trapping efforts were resumed May 30 with much of the trapline set along the river and accessed by inflatable boat. River and road trapping continued until July 29, but was interrupted by a labour dispute until the third week of August when the river trapline was reopened. Ground work was terminated on September 9.

By May 16, three grizzlies had been fitted with radio collars, and fixed-wing relocation flights began. These flights continued approximately every week throughout the summer and monthly in the fall. Denning areas were located on December 9 and confirmed on March 3, 1983.

One hundred scats were collected throughout the season initially to determine what food sources were used and when. It was difficult to distinguish black bear from grizzly scats and sampling effort was not consistent because of the emphasis on trapping. Data presented are preliminary. A number of dated, known-individual scats will have to be collected and analyzed to verify grizzly food habits in the Kimsquit.

One den, several marking trees, and a number of daybeds were located and measured. Summaries of these data are also presented.

METHODS

Capture

Bears were captured with Aldrich foot snares using methods similar to those described by Flowers (1977) and commonly reported elsewhere in the literature (Wood 1976; Russell et al. 1979; Lloyd 1979). Cubbies were baited with meat scraps (10-20 kg) obtained from the local butcher and suspended in a burlap sack at the anchor tree. Spawned-out sockeye salmon from Kimsquit Lake were also utilized during the spring. Some sites were prebaited (Hamer et al. 1981). Trap location varied according to method of access: helicopter, boat, or road. Trail sets near cubbies and along spawning channels were also utilized. Trap transmitters built by F. Anderka of the Canadian Wildlife Service were employed (Russell 1978).

Bears were free-ranged when feasible; that is, when vegetation was open and the safety of both bear and crew was ensured.

Handling

Approach, immobilization, and handling procedures were similar to those reported in other bear research programs (Lindzey and Meslow 1977; Lloyd 1979; Russell et. al. 1979; Glenn and Miller 1980). After initial determination of how the bear was held, if it were alone, and its approximate weight, handlers withdrew to prepare the immobilization drug (M99 etorphine hydrochloride, Cyanamid Canada Ltd.). Dosage was approximately 1 cc per 100 lbs. and was administered with either a jabstick or a Dist-Inject rifle (Biosonics - Edmonton, Alberta). Immobilized bears were moved to prone position and the cable either removed or loosened.

Depth of immobilization was monitored by breath rate. Larger grizzlies were fitted with radio collars and smaller grizzlies with ear tag transmitters (Telonics - Mesa, Arizona) (Servheen et al. 1981). All captured bears were fitted with plastic ear tags and the black bears with colour-coded ear patches made from Herculite cloth. A premolar tooth was removed from each bear for aging by cementum section. General examination of body condition was made including presence of scarring and ectoparasites. Several body measurements were taken.

Aerial Relocation

The majority of the flights were conducted in an amphibious float-equipped Cessna 185. Receiving equipment consisted of two Telonics "H" antennae connected to an attenuating switch box and a scanning receiver. Antennae were mounted mid way on the struts using brackets first developed by the California Department of Fish and Game (B. Cole, pers. comm.). Once a signal had been received, the bear was tracked as accurately as possible and the position and its associated uncertainty were plotted on a 1:50 000 topographical map. Unless the bear(s) were observed, accuracy was considered 100 m or greater (2 mm on 1:50,000 map). For each location: time, time tracked, air survey altitude, receiving distance, pulse rate, activity (if sighted), and general habitat type were recorded during the flight. Locations were later assigned: days since last location, elevation, aspect, soils/vegetation type (Louie 1975), forest cover type (B.C. Ministry of Forests), straight line distance to last location, and Universal Transverse Mercator (UTM) Grid Co-ordinates (with uncertainty).

Home Range Determination

For selected locations (verified ground and aerial), date, julian date, UTM, and uncertainty code were keypunched and computer-filed. Using a program developed by Harestad (1981), the 100, 90, and 50% home ranges were graphically outlined and their area measured. A subprogram was written to convert the UTM X and Y input coordinates to feet.

Scat Collection

Scats were collected as encountered. Samples were air dried in the field and stored in paper bags until analysis. In the lab, scats were resaturated and washed through screens of two mesh sizes (4 mm and 1 mm) and five subsamples randomly selected for examination under a stereo microscope (2-and 4X). Species identification, particularly for grasses and sedges, was not always possible. Percent occurrence by volume were recorded in the following classes (Servheen and Lee 1979): 0-1, 1-5, 5-25, 25-50, 50-75, 75-95, 95-100, and averaged for the five portions. Although recorded separately, when more than one part of a single plant species was consumed, proportions were combined for summary. Species identification was assisted by a guide prepared for the food habits of bears in Knight Inlet (Fleck et al. 1977).

RESULTS AND DISCUSSION

Capture and Handling

The greatest proportion of field work in 1982 was spent constructing, setting, and checking traps (Table 5).

Capture and handling data are summarized in Appendix C for both black bears and grizzlies. Twenty-two black bears (3 females, 19 males) were caught 28 times. Twelve grizzlies (5 females, 7 males) were caught 14 times. One bear, (number 26) an adult male grizzly, died as a result of capture (Appendix E).

Cubby sets proved most effective for capturing black bears and young grizzlies. Only one adult grizzly - bear 5 - was caught in a cubby set. Blind trail sets, particularly those that had not been recently disturbed, were most efficient for grizzly capture. Seven black bears and one grizzly were free-ranged.

As mentioned, the spring capture session began on April 19. Over the next month, a forty-hour helicopter contract (Hughes 500D) allowed a large trapline to be kept open. The snowpack was particularly heavy in 1982 and although some bear activity had been observed as early as April 20, no captures occurred until May 7. In the remaining 11 days of the contract, 10 more bears were captured (Table 5). One of these bears, an adult female grizzly (bear 8), with two male yearlings (bears 9 and 28), was darted from the helicopter on the estuary tidal flats while one of her cubs was in a snare in the adjacent forest. The family was reunited soon after capture.

The summer trapline (Table 5) was established and monitored primarily by Zodiac inflatable boat. Due to limited horsepower and propeller drive, access was restricted to the lower 6 km of river (Fig. 4). Two of the side channels were large enough for the boat allowing greater coverage. River access had advantages over ground monitoring by minimizing human scent and providing a safe approach corridor.

The fall or "salmon" trapline (Table 5) was not as productive as anticipated. Trail sets along spawning channels were made during this period and were successful in only one capture, an adult male grizzly (Bear 34). Other investigators have used this technique with varying success (Wood 1976; Modaferri 1981). Fall trapping may be more successful in 1983 by keeping the line open until well after the majority of the berries have ripened and dropped.

The trap transmitters were very effective in reducing both helicopter landings and the frequency of ground checking (Russell 1978). Sites were ground checked every other day regardless of the transmitter's signal and the "greens" or fresh brush used as visual barriers were replaced at this time. A deactivated signal indicated that the trap had been sprung and, since only a few transmitters were on the same frequency, it was often possible to travel directly to the capture site. By monitoring in the early morning, the time a bear was held was minimized. While no capture occurred in which the transmitter was not deactivated, on several occasions sites had been visited by bears and bait removed without our knowing. This disadvantage was outweighed by the advantages:

Table 5. Trapping summary, 1982.

Session	Start date	Finish date	Days traps set	Trap nights	# of Traps set	Access method	No.of black bears captured	No. of grizzly bears captured
Spring	Apr. 19	May 18	29	582	38	Helicopter	5	6
Summer	May 30	Jul. 28	54	492	44	Truck and boat	21	7
Fall	Aug. 21	Sep. 8	15	160	26	Truck and boat	2	1
Total[b]			98	1234			22 bears caught 28 times	12 bears caught 14 times

[a] Represents total number of trap sites during session (i.e. not all at once)

[b] Days traps set per new grizzly capture = 98 ÷ 12 = 8.2
Days traps set per new black capture = 98 ÷ 22 = 4.5
Trap nights per new grizzly capture = 1234 ÷ 12 = 103
Trap nights per new black capture = 1234 ÷ 22 = 56.1
Days traps set per capture (both grizzly and black) = 98 ÷ 42 = 2.33
Trap nights per capture (both grizzly and black = 1234 ÷ 42 = 29.4

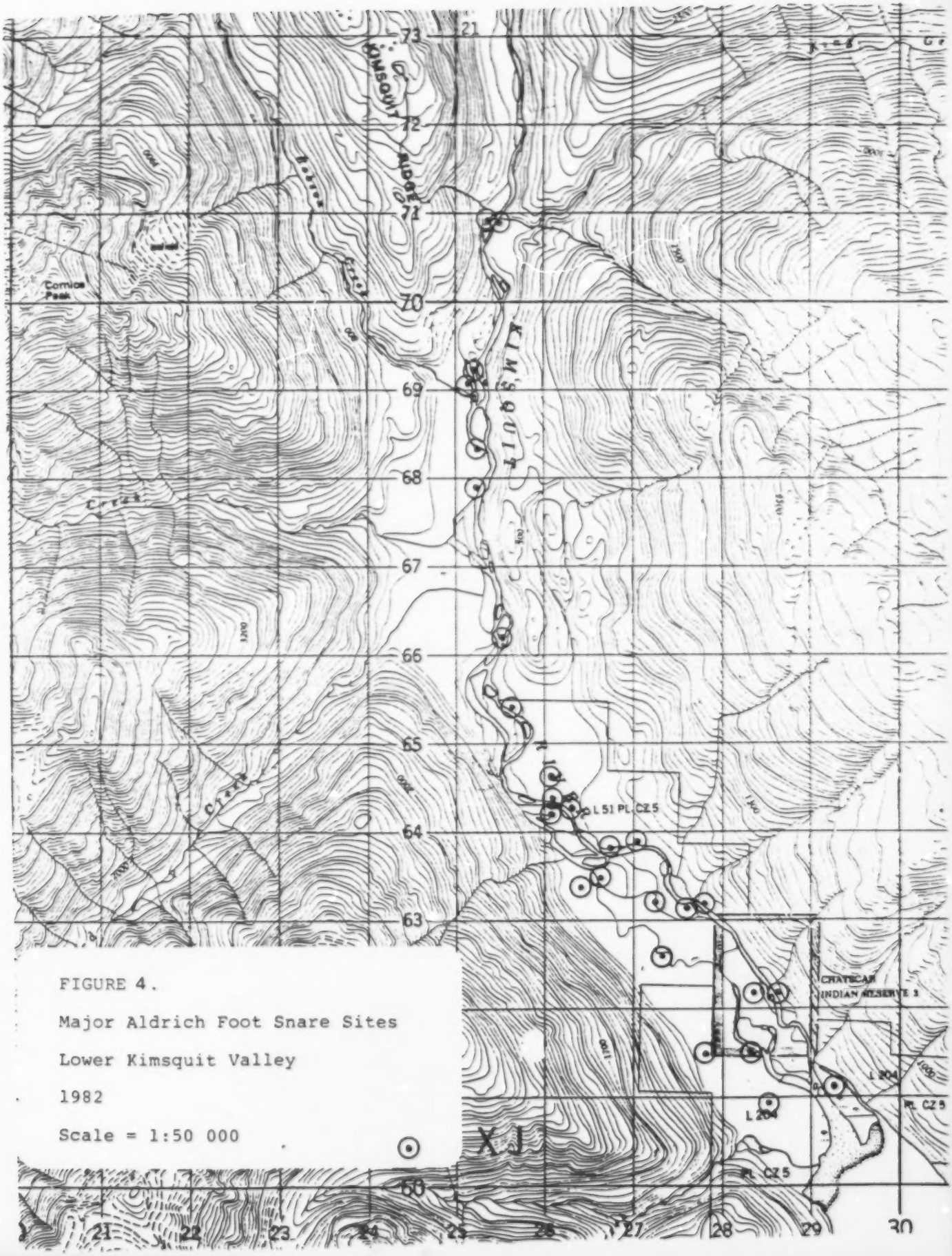

FIGURE 4.

Major Aldrich Foot Snare Sites

Lower Kimsquit Valley

1982

Scale = 1:50 000

time spent checking and human scent were minimized and knowledge of possible captures was immediate within receiving range.

Significant wounds from the cable were observed at five captures despite having swivels built into the cable length. These were treated with antibiotic powder. Site disturbance varied; it was evident that some bears made every effort to escape, while others seemed resigned to the capture.

Three yearling grizzlies (Bears 24, 27, and 28) were fitted with ear tag transmitters and five adults and one subadult grizzly with a radio collar.

Three bears, all subadult male blacks, were in noticeably poor condition. Maximal tooth wear (broken canines, pitted molars) was noted for four bears; 10, 21, 25, and 29. Pelt condition varied and some scarring was noted. Grizzly pelts were commonly rubbed; bear 25 had a large patch of bare skin.

A swollen vulva, indicative of estrus, was observed on only one occasion (black bear 22, June 29). This bear was accompanied by a male (bear 23) at the time of her capture.

Aerial Relocation Summary

Aerial monitoring data of transmitter equipped bears are summarized in Table 6 and relocations in Table 7.

1. Movements

Bear 01 - Adult Male - 12-years-old.

Bear 01 provided the greatest amount of movement information. Between May 16 and July 6, he travelled to (and returned from) the upper valley on at least two occasions. His maximum straightline distance between consecutive locations was 34.3 km (in seven days). On June 24, he was observed walking across a snow-covered slope opposite the mouth of Chasquot Creek accompanied by a blonde-coloured adult, presumed to be an estrus female. Although not confirmed, this bear's late summer and fall movements seemed confined to the lower valley. He denned in the King George Creek drainage.

Bear 02 - Subadult Male - 2-years-old.

Bear 02 was fitted with a loose fitting radio collar on May 9 but was not located again until September 28, despite two extensive high altitude aerial searches. He had left the Kimsquit watershed and was found in the "Kimsquit" Indian Reservation on the lower Dean River. Subsequently, he travelled as far up as Nuglein Creek, and denned in the Lower Dean.

Bear 05 - Adult Female - 10-years-old.

The movements of bear 05 were much more extensive than those recorded for the other two adult female grizzlies. Accompanied at her capture site on the Kimsquit River(at Salient Creek) by another bear (believed to be her cub) she was observed twice subsequently, alone both times. Bear 05's habitat use patterns also appeared different from those observed for other collared animals. She frequented higher elevations - her average relocation altitude was 5400 m

Table 6. Aerial relocation flight summary, 1982

Survey no.	Date	Aircraft	Bears located
825	May 16	Cessna 185	01, 05
826	May 28	" "	05, 08
827	June 01	" "	01, 05, 08
828	June 12	" "	01, 05V[a], 08V
829	June 18	Hughes 500D	01
8210	June 24	Cessna 185	01V, 08
8211	June 29	" "	01, 05, 08
8212	July 06	" "	01, 05, 08, 24, 25[b]
8213	July 15	" "	01, 05, 08, 24, 25, 27, 28
8214	July 22	" "	01, 08, 24, 25, 27, 28
8215	July 29	" "	01, 05, 08, 24, 25, 27, 28
8216	Aug 20	" "	01, 05V, 08, 24, 25, 27, 28
8217	Aug 26	" "	01, 05, 08, 24, 25, 27, 28
8218	Sep 02	De Havilland Beaver	01, 05, 08, 24, 25, 27, 28, 34
8219	Sep 28	Cessna 185	01, 02, 05, 08, 24, 25, 27, 28, 34
8220	Oct 12	" "	01, 05, 08, 24, 25, 27, 28, 34V
8221	Oct 27	" "	01, 02, 08, 24, 25, 28
8223	Nov 18	" "	01, 02, 08, 25
8224	Dec 09	Hughes 500D	01, 02, 05, 08, 24, 25, 28

[a] V = Visual
[b] = Accompanying bear 24,
(25 was captured July 08)

Table 7. Summary of aerial relocation by bear, 1982.

Bear No.	Locations	Comments
01	18	142 days between capture and 1st relocation
02	4	
03	14	
08	17	
24	11	All locations with Bear 25
25	12	
27	8	All locations with Bear 25
28	10	6 locations with Bear 08, 4 alone

(3400 ft.) ASL - and apparently did not descend to utilize spawning salmon. Similar patterns have been observed in southeastern Alaska (Schoen et al. 1983). This bear made several forays into Tweedsmuir Provincial Park and denned in the Salient Creek Drainage.

Bear 08 - Adult Female - 13-years-old.
09 and 28 yearling males.

Movements of bear 08, an adult female with two male yearling cubs, were confined to the lower valley, Pollard, and Cornice Creeks. Captured first on the estuary tidal flats along with one cub (bear 09), she was recaptured in a trail set in the lower valley on July 11. Her larger male cub, bear 28, was captured on July 15 and fitted with an ear tag transmitter. Bear 28 left bear 08 sometime between September 2 and 28 and was subsequently located in the vicinity of the mouth of Robson Creek on four occasions. A ground check on October 27 confirmed that 28 was alive and the transmitter still in place. Apparently, he denned in the same area. This family group was observed on May 8 travelling through cutting area 2. Tracking in the den vicinity suggests that bear 08 denned in the lower Pollard drainage with bear 09.

Bear 25 - Adult Female - 16-years-old.
24 female yearling 27 male yearling.

Captured later than the other grizzlies. (July), movement information on this family group is limited. However, like bear 08's family, their activities were restricted to the lower Kimsquit Valley. Both yearlings were captured and equipped with ear tag transmitters, and the signals were received concurrently with the female's up until October 12. No signals were received from the male cub (27) subsequently nor the female (bear 24) after November 11. Captured after the logging camp had shut down, no human activity-related information was collected for this family unit. Bear 25 denned in the Hoam Creek drainage and, again based on tracking in the snow near the entrance, was accompanied by at least one of her cubs.

Bear 34 - Adult Male - 11-years-old.

Bear 34 was captured along a salmon spawning channel in the Lower Kimsquit on August 31st. Between September 28 and October 11, he left the Kimsquit drainage and was sighted on October 12 walking along a logging road in the Lower Dean River Valley. No subsequent data was collected as Bear 34 was shot by a resident hunter in the lower Dean on October 14.

2. Home Range

Although sample sizes for accurate determination of home ranges were inadequate (Voigt and Lotimer 1980), preliminary data were summarized for bears 01, 05, 08, and 25. An example of computer home range area determination is presented in Figure 5; Appendix D gives an example of home range area calculation. In this example, aerial location data were supplemented by ground location information. Despite this addition, only half of the required 40 points were obtained (Voigt and Lotimer 1980). Preliminary data suggest that extensive home range overlap occurs.

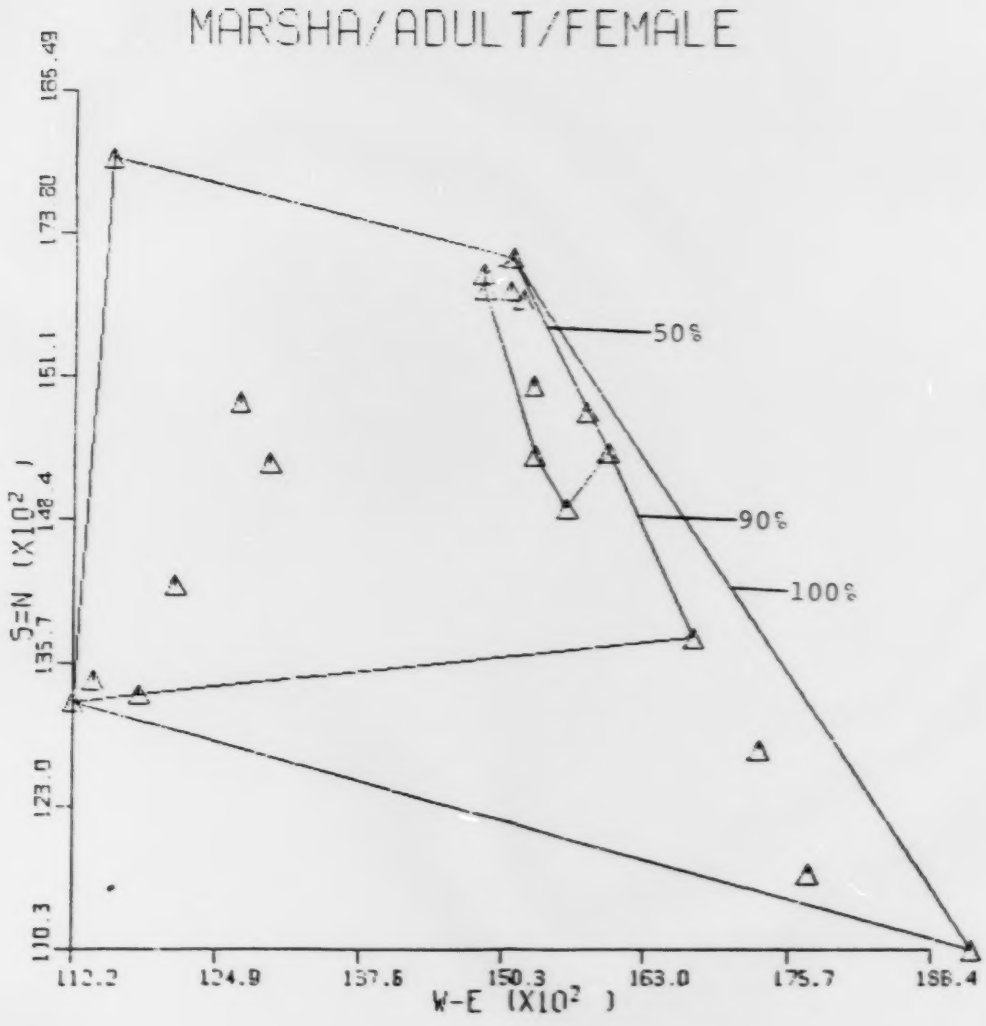

Figure 5. Example of Home Range Outline - Bear 08

3. Habitat Selection

Seasonal movements and habitat selection patterns of coastal grizzly bears have been discussed in a number of reports (Perensovich 1966; Russell 1974; Lloyd 1979; Smith 1978; Wood 1976; Schoen 1982; Schoen et al. 1983). More detailed information has been obtained for black bears in coastal habitats, with some studies concentrating on the impacts of timber harvest (McCollum 1973; Lindzey and Meslow 1977; Lindzey et al. 1983; Modaferri 1981). A body of literature describing habitat relations of the Kodiak bear (Ursus arctos middenorffi) and Alaska penninsula brown bears may also be helpful (Atwell et al. 1980; Berns et al. 1980; Glenn 1976; Glenn and Miller 1980; Hensel et al. 1981).

Spatial and temporal patterns of coastal grizzly bear habitat use appear to be associated with:

i) the seasonal availability and phenology of highly digestible, protein and energy-rich plants, and plant parts of limited distribution;

ii) the distribution, seasonal availability, and accessibility (to grizzlies) of spawning salmon; and

iii) the opportunity of finding animal food items other than salmon. (Archibald and Edie 1982).

Insufficient data were collected to develop an initial model of coastal grizzly bear seasonal habitat selection patterns. Some trends were observed, including:

1) Use of the estuary tidal flats area by both transmitter-equipped family units and bear 01. The timing of use varied. Two food sources were apparently utilized: new growth of the tidal sedges and Heracleum lanatum (cow parsnip).

2) Extensive early spring use of avalanche chutes by transmitter-equipped animals. These slopes, particularly those that are south-facing (which green-up early), appear to be especially important in June. Specific food items are unknown.

3) Heavy use of riparian habitats adjacent to salmon spawning channels in the lower valley in the late summer by both family groups and the adult male (chum and pink salmon and a number of berry species utilized).

It should be re-emphasized that one collared bear - adult female 05 - did not fit the above-noted pattern. This bear apparently used alpine and subalpine habitats including some avalanche tracks throughout the entire active season.

Scat Analysis

Analysis of 100 scats collected during 1982 is summarized in Tables 8, 9, and 10. Of these, verification of bear species was possible in 36 cases; 19 were known to be defecated by grizzlies, 17 by black bears. Exact dates of defecation were obtained when possible. More often, ranges of days, "fresh" or "unknown" age were recorded. Most scats were collected during the course of trapping

efforts. As a result, summaries given are only broadly representative of the timing and extent of utilization of the various foods.

Food species recorded were similar to those of other bear populations in that sedges and grasses, cow parsnip (Heracleum lanatum), ants, salmon, skunk cabbage, fern, Equisetum spp., and a number of berry-producing shrubs were utilized. The berries of two species, twinberry (Lonicera involucrata) and red-osier dogwood (Cornus sericea) were observed in a number of scats, suggesting that they are more important than for bear populations elsewhere in North America. Other than fish, no animal remains were found in any of the scats collected. Dates of first occurrence provide a rough indication of when the different food species were utilized (Table 9).

Grizzly Bear Dens

Den site characteristics of collared bears will be discussed in future reports. One known grizzly den was visited in 1982 and is described in Appendix F.

Daybeds/Mark Trees/Ground Marking

Some preliminary data were collected on the occurrence, location, and characteristics of daybeds, mark trees, and ground marking in the lower Kimsquit Valley.

The majority of daybeds located were associated with feeding on spawning salmon. Substrate varied; beds were dug in sand, humus, and rotting wood. Vegetation type and thus "cover" value were also not consistent, varying from open, unrestricted visibility to dense shrub. As with scats, verification of species was not always possible.

Three mark trees were found during the field season. Bear species was verified by claw marks and hair in tree sap. Tree species and size varied as did site characteristics. The role of mark trees in coastal bear social interaction is discussed by Lloyd (1979).

Ground markings or permanent bear trails (Lloyd 1979) were observed on three occasions, each in different vegetation types and on different substrates. More temporary trails - still with well-defined footsteps - were also encountered three times. The latter were associated with spawning salmon and proved useful in the capture of Bear 34.

Table 8. Analysis of grizzly bear, black bear, and unknown bear scats.[a]

Plant species	% occurrence			Parts[b] consumed		
	grizzly	black	unknown	grizzly	black	unknown
Oplopanax horridus (devil's club)	79(15)[c]	70(12)	63(40)	B,LS	B,LS	B,LS
Rubus spectabilis (salmonberry)	47(9)	47(8)	39(25)	B,S,L	B,S,L	B,S,L
Sambucus racemosa (red-elderberry)	47(9)	29(5)	39(25)	B	B	B
Vaccinium spp. (blueberries)	5(1)	47(8)	5(3)	B	B	B
Equisetum spp. (horsetails)	26(5)	12(2)	6(4)	A	A	A
Lysichitum americanum (skunk cabbage)	16(3)	6(1)	-	R(some L)	R(some L)	-
Athyrium filix-femina (lady fern)	11(2)	6(1)	6(4)	A	A	A
Carex spp. (sedges)	21(4)	6(1)	16(10)	A	A	A
Grasses	5(1)	6(1)	22(14)[d]	A	A	A
Viburnum edule (highbush cranberry)	-	-	3(2)	-	-	B
Lonicera involucrata (twinberry)	-	-	6(4)	-	-	B
Cornus sericea (red-osier dogwood)	-	-	3(2)	-	-	B
Heracleum lanatum (cow parsnip)	-	-	1(1)	-	-	A
Salmon	5(1)	-	-	A?	-	-
Ants	-	-	3(2)	-	-	A
Fish	-	-	9(6)	-	-	A?

[a] No. of scats analyzed: grizzly = 19, black bear = 17, unknown = 64.
[b] Parts of plants: A = all parts, B = berries, L = leaf, LS = leaf stem, S = shoot, R = root.
[c] In brackets, no of scats in which plant species occurred.
[d] Marked as unknown, may not be grasses.

Table 9. First occurrence of food items in 1982 scats.

Scat no.	Plant species	Parts consumed	Date first collected
9	Oplopanax horridus	LS	June 10[a]
22	" "	B	June 29[a]
12	Rubus spectabilis	S	June 14
21	" "	L	June 28
30	" "	B	July 02[a]
35	Sambucus racemosa	B	July 03[a]
1	Carex spp.?	L	May 16
31	Grasses	L	July 02[a]
13	Athyrium felix-femina	L	June 16
23	Lysichitum americanum	R (some L)	June 30
11	Heracleum lanatum	A	June 12
23	Equisetum spp.	A?	June 30
103	Viburnum edule	B	Aug 28[b]
101	Cornus sericea	B	Aug 25[b]
44	Vaccinium spp.	B	July 10
41	Lonicera involucrata	B	July 01

[a] Known defecation date/known bear
[b] Known defecation date

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Appendix A. Summary of Climatic Data. (Yole et. al. 1982) (Environment Canada 1982)

Parameter	CWHh Bella Coola	Transition Kemano
Mean annual temperature (°C)	7	7
Mean total precipitation (mm)	1530	1887
Mean total snowfall (mm)	1729	3411
Mean T. May - September (°C)	14	14
Mean ppt May - September (°C)	348	400
Mean T. Coldest month (°C)	-3	-4
Number of days of frost	124	136
Extreme minimum T (°C)	-29	-23
Mean T. June - August (°C)	15.5	15.5
Mean T. Warmest month (°C)	16	16
Extreme maximum T. (°C)	38	38
Driest month	June	June
Total ppt. driest month (mm)	49	28
Wettest month	October	November
Total ppt. wetest month (mm)	231	290
Number of months with mean monthly T. below 0°C	2	3
Number of months with mean monthly T. greater than 10°C	5	5
Frost free period (days)	154	171

Years	Bella Coola 1971-1980	Bella Coola 1897-1980	Kemano 1952-1981
Mean daily temperature	7.4	7.3	6.5
Mean daily max. temp.	11.6	11.8	10.6
Mean total rainfall (mm)	1499.7	1301.5	1584.7
Mean total precip. (mm)	1711.9	1458.9	1867.0

Appendix B.

Ecosystem Units of the CWHh3 and CWHi3 Variants of the Coastal Western Hemlock Zone in the Kimsquit River Valley. (Pojar 1982)

A. Subzones and Variants

Elevation less than 300 m; Douglas-fir generally common; amabilis fir relatively uncommon in main canopy ..... CWHh3 Variant

i.e. Mid Coast Drier Transitional subzone; Transitional western hemlock (-Douglas-Fir-Amabilis Fir-Red-Cedar) Variant

Elevation 200-800 m; amabilis fir common in main canopy and as regeneration; Douglas-fir scarce ..... CWHi3 Variant

i.e. Mid Coast Wetter Maritime Subzone; Eastern Transitional Hemlock - (Amabilis-Fir) Variant

B. Ecosystem Associations

CWHh3

101 Zonal hemlock - (Douglas-fir) - Vaccinium - moss
  101(1) Herb variation
    101(a) Folisolic phase
    101(b) Steep colluvial phrase
102 Dry Douglas-fir-salal-kinnikinnick-moss-lichen
103 Submesic hemlock - moss
  103(1) Douglas fir - salal variation
  103(2) Vaccinium variation
104 Moist Oak fern - moss
  104(1) Douglas-fir-sword fern variation
105 Devil's Club-fern
106 Floodplain spruce-devil's club
  106(1) Cottonwood-salmonberry variation
107 Skunk Cabbage

CWHi3

101 Zonal hemlock-amobilis fir - Vaccinium - moss
  101(1) Cold air drainage variation
  101(2) Herb variation
    101(a) Folisolic phase
    101(b) Shallow soil phase
102 Submesic hemlock - (amabilis fir-Vaccinium)-moss
103 Moist hemlock - amabilis fir-Vaccinium-fern
104 Lady fern (no plots)
105 Devil's club-fern-leafy moss
  105(a) Colluvial phase
  105(b) Folisolic phase
106 Floodplain spruce-devil's club
  106(1) Cottonwood variation
107 Skunk cabbage (no plots)

Appendix C1. Black bear capture record, 1982.[4]

No.	Name	Age	Sex	Day	Mon	Loca	Est wt. (kg)	Act wt. (kg)	Tth wear	Neck circ	Zygo (mm)	Cbl	Nose to tail (mm)	Shld ht. (mm)	Hert girt (mm)	Max girt in (mm)	Max girt out (mm)	Frnt toe to sole (mm)	Frnt pad width (mm)	Rear toe to sole (mm)	Rear pad width (mm)	Colour	Comments
06	Sitka	14	M	15	05	Swamp	115		Mod	580	209	305	1805		880	1030	985	112	123	213	102	Very dark	Sighted earlier in day near site. Baculum 168.
07	Tsuga	8	M	16	05	Swamp	70	75	Min	535	235	285	1690		860	910	990	115	103	182	104		Shy bear - tear in right ear from capture. Baculum 182.
12	Lenny	3	M	31	05	Air strip	70	75	Min	462	175	295	1410	700	760	861	835	103	107	167	93	White chest V	Lost weight by 2nd capture? Baculum 154, 168.
				05	07	Bacon				435	195	305	1405	710	720	810	775	118	110	165	102		
13	Chester	6	M	03	06	Air strip	100	90	Mod	489	235	325	1375	680	805	945	870	102	103	182	94		Held by 3 toes - dart hit pelvis and bent needle. Baculum 168.
16	Dillinger	3	M	08	06	Camp	70		Min	465	180	285	1485	620	740	880	805	111	112	185	102	White chest	Poor condition - both captures. Body measurements 1st capture only. Baculum 132.
				29	06	Antenna																White chest V	
17	Wally	3	M	09	06	Camp	100		Min-Mod	538	192	270	1435	590	740	845	785	105	102	176	93	Very dark	Bear shot by project personnel later on 09/06. Baculum 162.
21	Dale	3	M	20	06	Skunk Cabbage	70		Mod	550	219	286	1576	774	852	977	965	115	110	183	90	Small white chest V	Upper left canine broken but worn down. Baculum 162.
20	Hoola	3	M	10	06	Camp	70		Min	395	190	260	1335	630	678	765	765	98	96	162	87	Brown muzzle	Curious young - very good condition both captures. Dark - Baculum 140.
				28	08	Skunk Cabbage									830								
30	Teddy	8	M	18	07	Blueberry	90		Mod	545	210	317	1705	850	835	960	900	110	105	185	95	White chest V - brown muzzle	Bear in good condition. Baculum 175.
31	Albert	3	M	26	07	Easy	35		Min	440	175	300	1360	728	720	880	850	100	90	180	95	White chest V - brown muzzle	Small thin bear in company of bear 32 - Baculum 150.
				27	07	Easy	45																
32	Boo Boo	3	M	26	07	Easy	45		Min	460	180	290	1410	760	730	895	850	95	110	180	100	Slightly brn. muzzle	Small thin bear in company of bear 31 - Sibling? Baculum 148.
14	Lily	5	F	05	06	Camp	90		Mod	445	190	285	1460	620	730	872	785	98	89	165	90	Very dark	No brown or white - reweighted several times - estrus? recovery.
18	June	4	F	10	06	Skunk Cabbage	90		Mod	415	185	170	1445	650	688	808	760	115	107	152	87	Brown muzzle	No evidence of nursing or estrus.
22	Maggie	12	F	29	06	Knife	45		Mod	425	210	255	1310	710	680	848	745	95	90	158	82	Brown	Definitely in Estrus (1st capture). Possible estrus (2nd capture).
				07	07	Snake					185	275	1410	710	710	875	805	103	93	155	82	muzzle	
4	Skuce	7	M	10	05	Skuce	75		Min	527	185	295	1700	640	945	1050	965	110	105	180	100	Dark	Capture location outside Kimsquit watershed - Baculum length 133 mm.
10	Jack	16	M	17	05	Trapper	115		Max	605	225	315	1715	590	1045	1078	1050	117	114	198	110	Dark white V	Chest patch - white V - noticable grooves in canines missing left upper 1, 12, 13 - Baculum 182.
15	Clyde	16	M	06	06	Estuary	115		Mod-Max	575	230	295	1710	620	932	1045	980	117	115	205	107	White chest V	Very substantial wound to anterad foot - self-inflicted. Wrist okay - Baculum 185.
19	Sam	7	M	10	06	Knife	115		Mod	635	230	305	1710		955	1070	1010	128	126	210	112	White chest V and neck	Held by three toes (claws), dark muzzle. Baculum 195.
23	Fritz	10	M	29	06	Knife	115		Mod-Max	615	255	330	1665	880	935	1055	1010	125	122	195	98	Brown muzzle	Accompanying bear 22 at 1st capture - lost eartags by 2nd capture - Baculum 195.
				24	08	Antenna				632	235	315	1725	890	1070	1190	1155	130	130	190	110		
29	Yogi	10	M	24	07	Hosanna	90		Max	580	220	310	1730	800	940	1100	1080	115	117	217	110	White chest V - brown muzzle	Hindquarters rubbed - Baculum 195.
33	Leroy	7	M	24	07	Easy	90		Mod	540	210	330	1595	800	1000	1120	1100	100	110	195	100	White chest V - brown muzzle	Free ranged at capture site of bear 31 and 32. Baculum 155.
3	Curt	7	M	09	05	Salahager	90		Min-Mod	579	240	320	1600	740	875	1020	960	115	127	202	108	Brown muzzle	1st black bear captured - Baculum 150.

[4] Legend for column headings:

No. - Bear number
Day-Mon - Capture date (1982)
Loca - Location (each set given name)
Est wt (kg) - Estimated weight
Act wt (kg) - Actual weight
Neck circ - Neck circumference (maximum)
Tth wear - Tooth wear (maximum, moderate or minimal)
Zygo - Zygomatic width (maximum width across cheek bones)
Cbl - Condobasal length (maximum skull length)
Nose to tail - Total length nose to tail
Shld ht - Shoulder height
Hert girt - Heart girth
Max girt in - Maximum girth breath
Max girt out - Maximum girth breath out
Frnt and rear toe to sole - Maximum length to to sole in front foot
Frnt and rear pad wdth - Maximum length across pad front foot
Colour - brief description of colouration

Appendix C2. Black bear capture record, 1982.[4]

No.	Name	Age	Sex	Day	Mon	Locn	Est wt. (kg)	Act wt. (kg)	Tth wear	Neck circ	Zygo (mm)	Cbl	Nose to tail (mm)	Shld ht. (mm)	Hert girt (mm)	Max girt in (mm)	Max girt out (mm)	Frnt toe to sole (mm)	Frnt pad width (mm)	Rear toe to sole (mm)	Rear pad width (mm)	Colour	Comments
1	Jason	12	M	07	05	Bacon	180		Mod	868	330	440	2160	900	1330			155	165			Brown	Unusually active during handling. Left mandible had been broken but ossified. 10 cc antidote at 106:00 - unknown recovery.
26	Louie	8	M	09	07	Channel	300	225	Mod	785	325	440	2185	1200	1285	1440	1405	162	175	260	162	Brown	Died as a result of capture overnight 09/07.
34	Earl	11	M	31	08	Hollow Hemlock	275		Max	895	335	465	2325		1405			165	187	265	205	Blonde head brown	Summer coat short hair except head. Extreme tooth wear - ULC broken. Recovery with 14 cc at 10:45 by 10:56.
05	Sandy	10	F	11	05	Salient	150		Mod	660	240	345	1920	775	990	1180	1150	135	147	225	128	Brown	No evidence of nursing - teat 25 mm. Accompanied by one cub chased away. White-tipped claws.
08	Marsha	13	F	17	05	Estuary	150		Max		235	380	1895	1000	1455	1305	1200	140	135	223	118	Dark brown	Definite evidence of nursing teat 19 mm. Recaptured teat bag trail 11.07. Heart girth loss. Ear tag missing - 2 cubs - bears 07 and 28.
25	Shelly	16	F	08	07	Bacon	160		Max	585	265	380	1785	955	1085	1340	1265	130	140	212	120		Extreme tooth wear - lower rt. canine largest (21 mm). All others worn/missing. 1,3 molars pitted-bare patch on back - fresh sign of nursing - 2 cubs - bears 24 and 27
09	Billy	1	M	17	05	Estuary	35		Min			382	1185	525	655	763	690	102	105	157	96	Lt. brown w/longer darker hair on ankles and rump	Yearling cub of bear 08 in snare while mother free-ranged
11	Jenny	1	F	17	05	Moose	35		Min	410	195	265	1197		689	770	705	102	106	172	104	Light brown	Dark brown shins and feet. Blonde head and rump - accompanied by unknown bear at time of capture.
24	Coleen	1	F	03	07	Ken's	60		Min	390	195	270	1400	730	730	840	740	123	125	180	115		Canines not fully erupted - cub of bear 25 - pelt in poor condition. Fit with ear tag transmitter; right ear.
27	Jamie	1	M	12	07	Cedar Beaver	45		Min	385	175		1295	780	712	865	805	111	112	175	115	Lt. brown darker legs	Recaptured 18/07 - wound on arm from previous capture. Cub of bear 25. Fit with ear tag transmitter.
28	Stuart	1	M	15	07	Orange Pool	45		Min	430		315	1315	810	785	895	860	112	122	190	100	Darker brown like mother	Other cub of bear 08 - larger and darker than brother (bear 09) - fit with ear tag transmitter.
02	Stanley	2	M	09	05	Skunk Cabbage	100		Min-Mod	602	240	355	1805	790	910	1075	980	148	155	242	128	Light except limbs	Only single subadult captured - fit with loose radio-collar.

Appendix D. Home range area calculation.

Identification: Marsha - Adult/Female

Date	Time	Acrcy	X	Y	Days since last location
17/05/82	0835	1	63024.00	36187.00	0.
28/05/82	1329	4	37401.00	44028.00	11.
01/06/82	1114	4	50262.00	52591.00	4.
07/06/82	0	9	56791.00	42027.00	6.
09/06/82	2115	1	58234.00	38385.00	2.
12/06/82	1204	1	36811.00	43405.00	3.
24/06/82	1258	4	38746.00	43602.00	12.
29/06/82	1448	4	39763.00	46751.00	5.
06/07/82	1710	1	37893.00	59219.00	7.
11/07/82	0855	1	54954.00	45275.00	5.
15/07/82	1416	2	52493.00	50688.00	4.
22/07/82	1511	2	49934.00	55150.00	7.
29/07/82	0854	1	50295.00	50590.00	7.
20/08/82	1408	1	49507.00	55413.00	22.
26/08/82	1406	1	48753.00	55413.00	6.
02/09/82	1529	3	48720.00	55872.00	7.
28/09/82	1607	4	51837.00	51837.00	26.
12/10/82	1627	1	49606.00	56364.00	14.
27/10/82	1112	1	51279.00	49048.00	15.
18/11/82	1010	2	42519.00	50360.00	22.
09/12/82	1102	1	41633.00	52099.00	21.

Earliest Location Date: 17/05/82 Time: 0835
Latest Location Date: 09/12/82 Time: 1102
Total Number of Locations: 21

Percent Home Range			Number of	Area	
Approx	Exact		Locations	Acres	Hectares
100	100.0		21	7120.8	2881.7
Vertices of polygon:		63024.00	36187.00		
		49606.00	56364.00		
		37893.00	59219.00		
		36811.00	43405.00		
	95.2		20	6155.4	2491.0
	90.5		19	5343.0	2162.2
90	85.7		18	4605.3	1863.7
Vertices of polygon:		54954.00	45275.00		
		52493.00	50688.00		
		49606.00	56364.00		
		37893.00	59219.00		
		36811.00	43405.00		
		38746.00	43602.00		

Appendix D. (Cont'd).

Percent Home Range			Number of	Area	
Approx	Exact		Locations	Acres	Hectares
	81.0		17	3003.2	1215.4
	76.2		16	2966.3	1200.4
	71.4		15	2826.2	1143.7
	66.7		14	2259.9	914.5
	61.9		13	1492.2	603.9
	57.1		12	1046.4	423.5
	52.4		11	864.9	350.0
50	47.6		10	255.4	103.3
Vertices of polygon:		52493.00	50688.00		
		49606.00	56364.00		
		48720.00	55872.00		
		48753.00	55413.00		
		50295.00	50590.00		
		51279.00	49048.00		
	42.9		9	215.4	87.2
	38.1		8	181.0	73.2
	33.3		7	111.5	45.1
	28.6		6	54.0	21.9
	23.8		5	20.3	8.2
	19.0		4	6.2	2.5
	14.3		3	4.0	1.6

Appendix E. Death of an Adult Male Grizzly as a Result of Capture.

On July 9, an adult male grizzly was captured between the hours of 0900 and noon. The cubby site had been checked earlier that morning and had been still set. At 1220 the bear was darted with 5.0 cc of M99 in the left shoulder. At 1236 an additional 1.0 cc was administered by hand as the bear still had some motor control. This was repeated at 1244. The breath rate did not decline normally (1 per 10 to 20 seconds). Despite the elevated breath rate, handling began at 1251. At 1259, the bear began to convulse violently; breath rate was rapid (1 per 2 seconds). A decision was made to administer more drug and 2.5 cc were hand injected at 1304. Breath rate still did not decline. Nineteen cubic centimetres of the antagonist M50-50 were administered at 1343, handling having been slowed by the bear's unusual reaction to the drug. Breath rate increased slightly to one per two seconds but the bear did not recover and died sometime during the night. The bear was weighed the following day at 225 kg, and a necropsy was performed. There were no apparent wounds; condition - internal and external - seemed normal. Five cubic centimetres should have been sufficient to immobilize a bear of this weight (Hebert et al. 1980); however, it is suspected that the action of the initial 5 cc dose was somehow slowed resulting in an "underdose." Subsequent injections could not reverse these symptoms, nor could administration of the antidote (Hebert and McFetridge 1979). In the future, all large grizzlies will be dosed heavily to try and prevent another incident of this type.

NOTE: Successful immobilizations were performed with drug from the same vial as used for bear 26.

Appendix F. Description of a grizzly bear den.

Location: UTM XJ 615750/5889350 - above Kimsquit River opposite Chasquot Creek.

Elevation: 2100 ft. (640 m)

Aspect: 56° (NE)

Slope: 75% up 80% down

Description:

This den, definitely occupied during the winter of 1981/1982, was located on an extremely steep northeast-facing slope above the upper Kimsquit River. The bear(s) had excavated under the horizontal trunks of a mountain hemlock (Tsuga mertensiana) tree. The den was first located on April 25 by helicopter. Numerous fresh tracks were sighted in the vicinity at that time. Assuming the den was empty, an attempt was made to examine it on May 3. The attempt was cut short, however, when a young grizzly was sighted (awake) in the den opening. On May 5 another attempt was made to sight the bear(s) by hovering in front of the den. There was no response after one minute. It was assumed that the den was now empty and it seemed likely that the animal(s) left the area in the early morning while the snow was still frozen as there were no fresh tracks sighted. There was strong evidence to suggest that the bear(s) emerged early, made a brief foray then returned to the den. Two ages of bedding (also mountain hemlock) were found, suggesting that after coming out in mid-April, more bedding was collected prior to re-entering the den. The number of tracks in the den vicinity support this idea. The spring of 1982 arrived late and the heavy snowpack and cold weather in late April probably kept the bears in the den longer than perhaps was normal. Ground measurements were taken on June 18.

The den was approximately 50 ft. (15 m) (vertical elevation) below a small plateau/meadow in a band of mountain hemlock trees. An avalanche chute ended at the meadow but seemed to pose no threat to the den. The following is a brief description of the vegetative cover in the vicinity:

Species	% Cover
Mountain hemlock	50
Vaccinium alaskense	75
Shrub alder (slide alder)	10
False azalea	30
Devil's club	5
Mountain ash	10
Lady fern	20
Trailing rubus	10
Oak fern	10
Bunchberry	10

Very little excavation was required to make a hollow under the horizontal trunks. The root structure of the tree actually formed the walls

Appendix F. (Cont'd).

of the den chamber. There were three openings and the major entrance faced northeast.

Approximately 30 pounds of mountain hemlock boughs lined the floor of the chamber. As mentioned it was of two ages; some were browned with no needles attached and the others had light green needles.

The substrate was colluvial and the chamber itself contained a number of large (50 cm) rocks. Below the centre of the horizontal trunks, the den floor was excavated to a depth of 12 cm. The little bit of soil that was removed was found mainly at the northeast entrance and formed a small porch.

The area was searched for fecal plugs but none were located.

Wildlife Working Reports should not be cited because of the preliminary nature of the data they contain

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WR-4 Habitat types of the Kimsquit River estuary. C. Clement. October 1984. 27pp. (Also printed as WHR-12).

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WR-16 Working plan - coastal grizzly research project. W.R. Archibald and A.N. Hamilton. October 1985. 27pp. (Also printed as WHR-21).

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